Study Plan

Straight Creek
Use Attainability Analysis

Submitted to:

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On behalf of:

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Preface

Biological Monitoring, Inc. (BMI) was contracted by the Virginia Mining Issues Group (Group) to provide technical expertise regarding Straight Creek (Lee County, VA) Total Maximum Daily Load (TMDL) issues. Those TMDL issues centered on Straight Creek's biological impairment and remediation goals. The Group questioned whether complete attainment is possible based on required effluent limits and cost effective and reasonable Best Management Practices (BMPs). Therefore, the Group proposed to conduct an aquatic life Use Attainability Analysis (UAA) to determine appropriate and achievable goals for Straight Creek and its tributaries.

A UAA is a structured scientific assessment of the factors affecting the attainment of the designated use. Designated uses are those uses specified in water quality standards for each water body or segment whether or not they are being attained. A UAA may include assessments of physical, chemical, biological, and economic factors. A document providing reasonable grounds that the use may be unattainable was prepared by BMI and submitted on behalf of the Group to the Virginia State Water Control Board (SWCB). The SWCB granted permission to proceed with the UAA based upon certain conditions. For example, the UAA study plan must be presented for public comment and ultimately approved by the Virginia Department of Environmental Quality (VA DEQ).

This UAA study plan reflects applicable Federal and State Water Quality Standards (WQS) regulations. The UAA study plan envisions the use of collected data to characterize the conditions that exist in Straight Creek. This characterization will allow the development of a predictive tool for estimating attainable aquatic life use in the watershed. As such, the UAA process will be integrated with the phased TMDL Implementation Plan (IP) and Virginia Pollutant Discharge Elimination System (VPDES) permits. The predictive tool will be used to forecast biological conditions in Straight Creek and its tributaries based upon remediation efforts recommended during the IP, the permitting process, and this UAA. Ongoing IP and permitting efforts will be monitored and integrated with this UAA. The predictive tool will be validated by monitoring the

effects of phased remediation efforts. In this manner, appropriate goals for improvements in Straight Creek and its tributaries may be achieved.

This study plan was prepared by BMI in cooperation with VA DEQ staff. There were numerous conference calls held between BMI and VA DEQ staff to define the procedural, conceptual and technical requirements of this UAA. Recommendations were incorporated into each of several drafts as the study plan was developed. This document represents a culmination of these efforts. As this project moves forward, study refinements may occur. Any such refinements will be submitted to VA DEQ.

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1.0 Introduction

1.1 General

A UAA is a structured scientific assessment of the factors affecting the attainment of the Designated Use. A designated use is defined as:

> *The water quality standards regulation requires that States and authorized Indian Tribes specify appropriate water uses to be achieved and protected. Appropriate uses are identified by taking into consideration the use and value of the water body for public water supply, for protection of fish, shellfish, and wildlife, and for recreational, agricultural, industrial, and navigational purposes. In designating uses for a water body, States and Tribes examine the suitability of a water body for the uses based on the physical, chemical, and biological characteristics of the water body, its geographical setting and scenic qualities, and economic considerations. Each water body does not necessarily require a unique set of uses. Instead, the characteristics necessary to support a use can be identified so that water bodies having those characteristics can be grouped together as supporting particular uses. (http://www.epa.gov/waterscience/standards/about/uses.htm).*

A UAA may include assessments of physical, chemical, biological, and economic factors. A UAA evaluates the reasons for use non-attainment, as well as provides a prescription for attaining the best use in a water body through remediation. The ultimate goal of any UAA is to determine the highest attainable use.

A key concept in assigning designated uses is "attainability," or the ability to achieve water quality goals under a given set of natural, human-caused, and economic conditions. Appropriate and defensible water quality standards are essential for achieving the Clean Water Act (CWA) goals of maintaining and restoring water quality - - and getting WQS right starts with getting designated uses right (EPA, 2006). The overall success of pollution control efforts depends on several factors, including a reliable set of underlying designated uses in water quality standards. Setting attainable water quality goals is important in stimulating action to improve and advance water quality.

Many designated use changes have occurred as a result of informative and compelling demonstrations provided by UAAs. A review of many UAA case studies reveals the

breadth and variety of UAAs (EPA, 2006). In some cases, such as the one for Chesapeake Bay, the UAA is extensive and resource-intensive. However, there are many effective UAAs that are much simpler, for example by conveying the appropriate designated use expectations principally through a set of photographs documenting the physical characteristics of the water body.

> *It is the prospective analysis of future attainability of designated uses that provides the demonstration necessary to support a use change. The EPA UAA program experience and future direction reflects a growing practice of "sub-categorizing" or "refining" designated uses; that is, making them more specific and precise as opposed to removing them (http://www.epa.gov/waterscience/standards/uaa/info.htm).*

The UAA process integrates ecological data to arrive at a more thorough understanding of how the various forces in and around a particular stream interact. This UAA will use these data to develop a tool that will allow the biological condition of Straight Creek to be predicted based on other physical, chemical or biological conditions in the watershed. The predictive tool will be used to determine the highest attainable aquatic life use based on the conditions expected and observed in Straight Creek after prescribed remediation.

1.2 Project Background

In July 2006, House Bill 1457 was enacted to amend § 62.1-44.19:7 of the Code of Virginia (Plans to Address Impaired Waters). The amendment is as follows:

> *E. If an aggrieved party presents to the Board reasonable grounds indicating that the attainment of the designated use for a water is not feasible, then the Board, after public notice and at least 30 days provided for public comment, may allow the aggrieved party to conduct a use attainability analysis according to criteria established pursuant to the Clean Water Act and a schedule established by the Board. If applicable, the schedule shall also address whether TMDL development or implementation for the water should be delayed.*

In October 2006, VA DEQ received from the Virginia Coalfields TMDL Group a document titled *Reasonable Grounds Documentation to Conduct an Aquatic Life Use Attainability Analysis for Straight Creek, Lee County, Virginia.* This documentation

asserts that attainment of the designated use for aquatic life may not be feasible because many of the impacts on the watershed may be irremediable.

Pursuant to § 62.1-44.19:7 of the Code of Virginia, a notice of public comment period was published in the Virginia Register on October 5, 2006. The comment period ended November 9, 2006. The Notice stated that the Board was seeking comment on the documentation submitted and if it constitutes reasonable grounds that attainment of the aquatic life use for Straight Creek is not feasible.

Comments from thirteen organizations were received and were summarized by VA DEQ. VA DEQ staff held a meeting on January 26, 2007 with those who commented and the Group to allow for further explanation of the proposal and discussion of comments.

At its meeting on March 9th, 2007, the SWCB determined that reasonable justification had been presented to move forward with this UAA according to criteria established pursuant to the CWA and in conformance with 9 VAC 25-260-10. The SWCB granted permission to proceed with the UAA subject to the following five conditions (VA DEQ 2007):

> *1. A TMDL Implementation Plan to address the aquatic life use impairment shall be submitted to VA DEQ by December 31, 2007 and approved by the Board. The Plan must identify the reasonable and cost-effective remediation steps required for use attainment under 9 VAC 25-260-10 E and I.*
>
> *2. A UAA study plan shall be presented for public comment and approved by VA DEQ before initiation of the UAA study.*
>
> *3. On-going implementation of cost-effective and reasonable best management practices identified in the TMDL Implementation Plan and Virginia Pollutant Discharge Elimination System (VPDES) permits shall continue so the response of the aquatic system to the implementation of these practices is included in the UAA study.*
>
> *4. Upon completion of the UAA study, VA DEQ staff will report back to the Board whether the results of the UAA study are deemed consistent with federal and state regulations and warrant initiating a rulemaking to*

establish subcategories of the designated use for aquatic life in all, or portions of, Straight Creek.

5. Moving forward with this study does not establish any precedent for what constitutes "reasonable grounds" under § 62.1-44.19:7.

A study plan was prepared by the group in coordination with DEQ staff. The DEQ staff sought public comment on the document and provided a summary of the responses. Staff provided the comments from the public as well as their own. The group responded to those comments with multiple drafts of the study plan. The study plan herein presented reflects staff recommendations as well as public comments.

2.0 Project Description

2.1 Overview

The EPA Technical Support Manual: *Water Body Surveys and Assessments for Conducting Use Attainability Analyses* contains technical guidance to assist States in implementing WQS Regulations (EPA, 1983). In addition, the EPA WQS Handbook (EPA, 1994) provides background information and a framework for the conduct of a UAA. The EPA recognizes that consideration of the suitability of a water body for attaining a given use is an integral part of the water quality standards review and revision process.

The purpose of this study is to conduct a UAA on Straight Creek in Lee County, Virginia. As defined in the WQS Regulations, a UAA is a structured scientific assessment of the factors affecting the attainment of the use which may include physical, chemical, biological, and economic factors as described in Title 40 of the Code of Federal Regulations (40 CFR 131.10 g). The UAA will be conducted on the designated aquatic life use of Straight Creek. Envrironmental Protection Agency UAA guidance is intended to assist States in answering three central questions. These questions have been incorporated into this UAA study as the objectives. These questions are:

1. Is the Designated Aquatic Life Use an Existing Use?
2. What is preventing the Designated Aquatic Life Use Attainment?
3. What is the Highest Attainable Aquatic Life Use after remediation?

This study plan presents methods for answering these three questions in the form of a predictive tool that will incorporate biotic and abiotic conditions to project the highest attainable level of aquatic life use for Straight Creek, as well as the criteria necessary to achieve and maintain this use. In addition, ongoing and anticipated remediation and monitoring efforts are presented.

This study may culminate in a number of different recommendations, ranging from (1) keeping the currently assigned use and criteria; (2) keeping the currently assigned use but proposing a new, protective, site-specific criterion; or (3) proposing a subcategory of the currently assigned use and corresponding, protective criteria.

2.2 Study Area

Straight Creek is located in Lee County, Virginia and is a tributary of the Powell River / Upper Tennessee River system. The headwaters begin near the Kentucky / Virginia border and flow south through St. Charles and connect to the North Fork Powell River near Pennington Gap Virginia. The area is located on the Pennington Gap United States Geological Survey (USGS) 7.5' quadrangle (Figures 1 - 2). Land uses in the watershed consist of forest, residential and mining. This watershed has a long history of timber harvesting, mining and residential influences.

The approved TMDL for Straight Creek lists four stations with benthic impairment. These stations were: river miles 0.11, 0.40, 2.48 and 3.62. The benthic macroinvertebrate surveys of these stations were performed between 1991 and 2004. Stations were evaluated using the EPA Rapid Bioasssessment Protocol Level II (RBPII). The scores from these stations ranged from the lower end of the moderately impaired range (27%, station 0.40, May 1992) to the slightly impaired range (68%, station 2.48, September 1999).

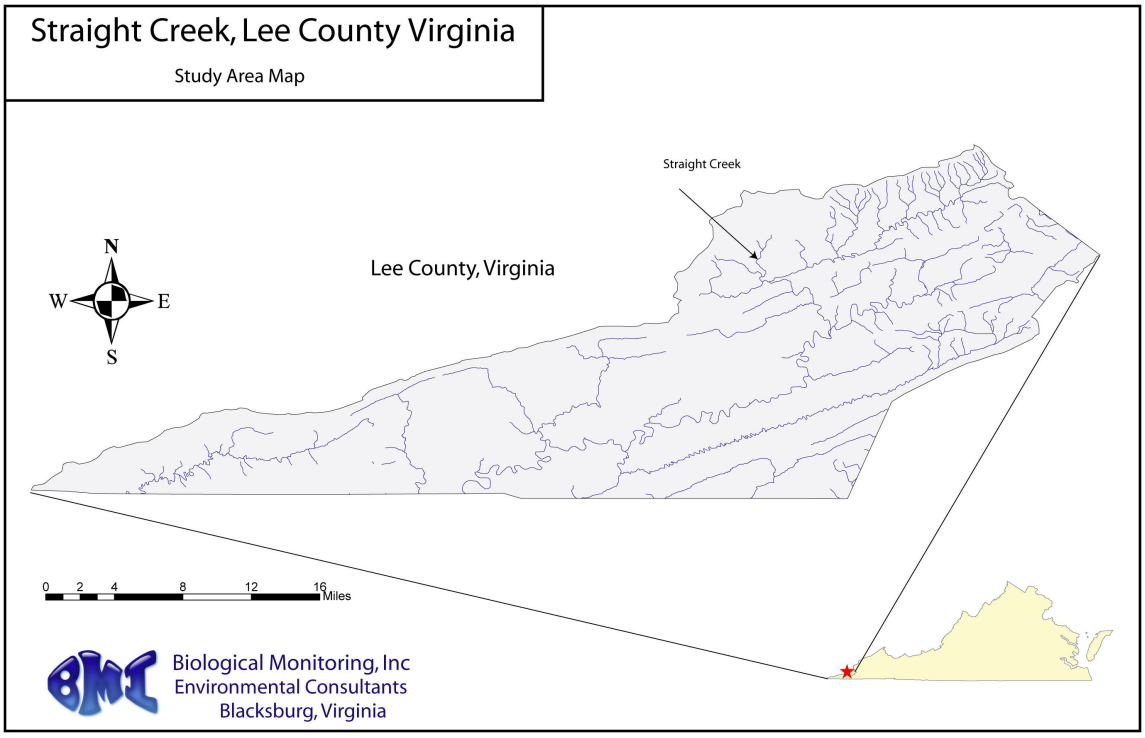

Figure 1 Location Map

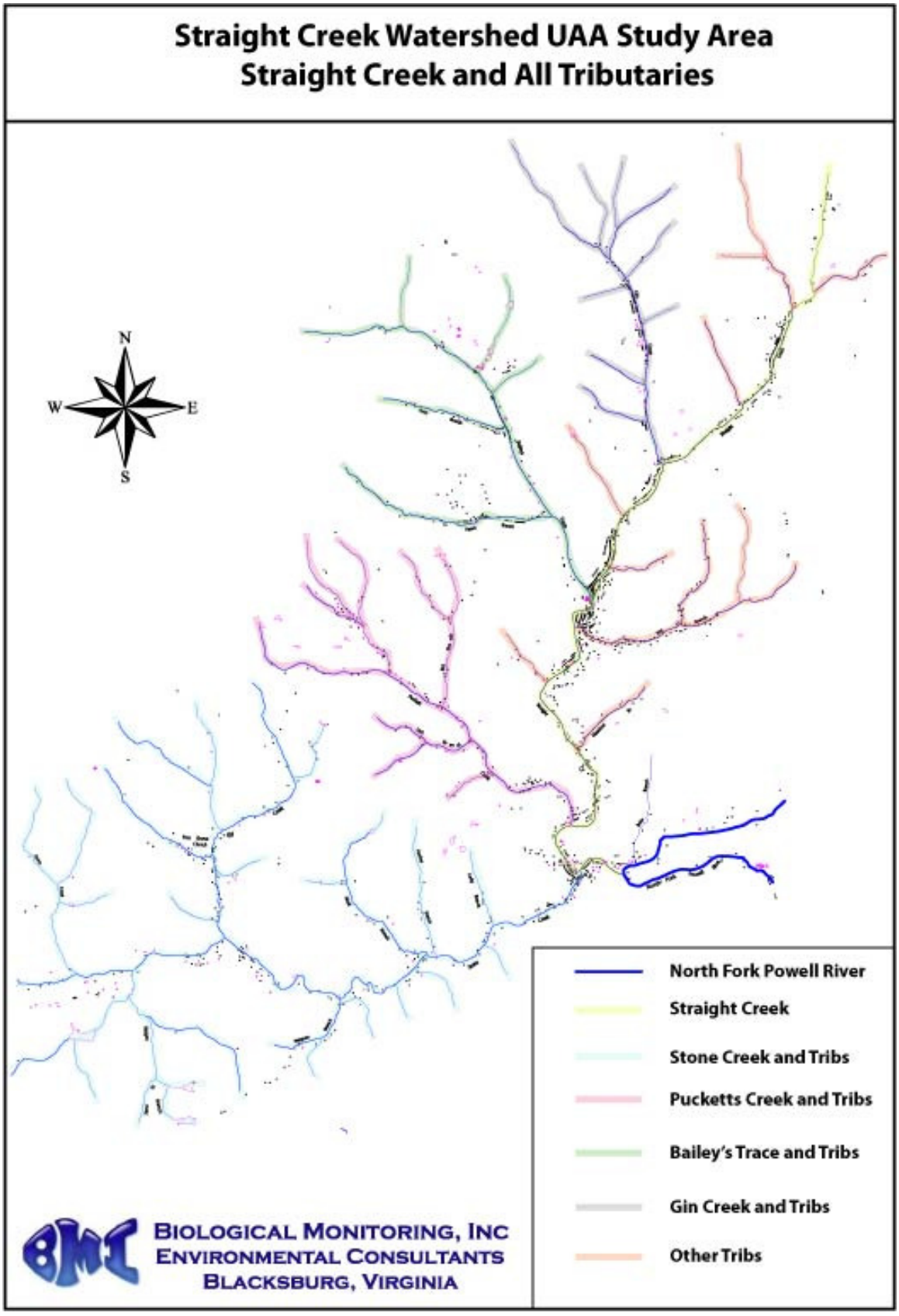

Figure 2 Detail Map of Study Area

2.3 TMDL Information

Straight Creek was determined to be impaired (bacterial standard) and included on the 1994 Virginia 303 (d) list of impaired waters. In addition, Straight Creek was determined to be impaired (general standard, benthic macroinvertebrate) and included on the 1996 Virginia 303 (d) list of impaired waters. As such, a TMDL study was conducted in 2005 and 2006. The TMDL identified unregulated sewage discharges and failing septic systems as the primary causes of the bacterial impairment. Furthermore, that study identified sedimentation and Total Dissolved Solids (TDS) as the most probable stressors affecting benthic health. The types of data used during the TMDL development will be reviewed and confirmed during the UAA process.

The TMDL IP and VPDES permitting will be integrated with this UAA. Implementation efforts will be phased and will address the bacterial and aquatic life use impairments. This UAA effort will focus only on the aquatic life use impairment. However, any and all TMDL IP remediation efforts could improve the ecological health of Straight Creek and/or its tributaries.

Implementation efforts are currently underway in the Straight Creek watershed. For example, there are abandoned mine land projects and sewage system development. Monitoring efforts continue (physical, chemical, biological) and pertinent data has been and will continue to be compiled before, during and after the projects have been completed.

2.4 Stakeholder Group

In order to relay information and data to the public and interested stakeholders, a stakeholder group will be formed. This group will be comprised of broad-based stakeholders and incorporate the public, state agencies, federal agencies, municipal government and others. To ensure inclusiveness, the VA DEQ will review and approve the list of stakeholders invited to participate in this group.

3.0 Is the Designated Aquatic Life Use an Existing Use?

3.1 Current Designated Use

Designated uses are those uses specified in WQS for each water body or segment whether or not they are being attained. All Virginia waters are designated for the following uses:

> …recreational uses, swimming and boating; the propagation and growth of a balanced, indigenous population of aquatic life, including game fish, which might reasonably be expected to inhabit them; wildlife; and the production of edible and marketable natural resources, fish and shellfish (9 VAC 25-260-10, **http://www.deq.state.va.us/wqs/documents/WQS_eff_9_11_07.pdf**).

Through the protection of these minimum uses, other uses such as industrial water supply, irrigation and navigation also are protected. Should additional standards be needed to protect other uses as dictated by law (such as public water supply) or improved knowledge, they will be adopted.

From a regulatory standpoint, the designation of uses is established by the CWA and its subsequent amendments as promulgated in the Code of Federal Regulations (40CFR131.10). All States are required to specify appropriate water uses to be achieved and protected. However, States are encouraged to refine uses by adopting sub-categories of uses and setting appropriate criteria to more accurately reflect varying needs of uses and sub-categories of uses. For example, a State may designate a sub-category of use for a body of water as a coldwater versus warmwater fishery. States may also adopt seasonal uses with varying criteria. Virginia has designated seasonal uses in the Chesapeake Bay.

In designating a use for a water body with the appropriate criteria, consideration must be made for the water quality standards downstream and states shall ensure that its water quality standards provide for the attainment and maintenance of the water quality standards of downstream waters. Thus, any recommendations resulting from this UAA will take into account downstream water quality standards.

Determination of the attainment of the designated aquatic life use throughout Virginia's freshwater ecosystems has been based upon macroinvertebrate survey guidelines (VA DEQ, 2007). The Straight Creek TMDL report presents 13 biological samples that were collected in Straight Creek from 1991 through 2004. The biological scores of those samples ranged from 14% (Station 0.40 1991) to 68% (Station 2.48 1999) of the reference streams using the VA DEQ / EPA RBPII method of water body assessment. In addition to the RBPII method, the VA DEQ-validated draft Virginia Stream Condition Index (VSCI) method, scheduled to be implemented in the 303(d)-305(b) report, was used to score the stream's biological condition in the Straight Creek TMDL report (VA DEQ, 2007). The VSCI scores ranged from 21.65 (Station 0.40 1992) to 48.4 (Station 0.11 2004) out of a possible 100, which is below the threshold of 61.3 used as a water quality goal in the TMDL.

These data demonstrate that Straight Creek is not simply a few points shy of achieving aquatic life use attainment. Although a TMDL study has been conducted, the VA DEQ has not yet had an opportunity to study non-pollutant contributions (*e.g.*, channel alteration, loss of riparian habitat, etc.) to impairment or their relative impact on the proposed restoration efforts. While control measures directed at pollutants like bacteria, TDS and Total Suspended Solids (TSS) may in some cases help to improve biological condition, conventional ecological theory tells us that there are also many non-pollutant factors that influence the aquatic community (EPA, 2005). Straight Creek's non-pollutant factors may hinder restoration, even with pollutant control measures in place. These non-pollutant factors must be addressed to assess the level of aquatic life use that can be attained in Straight Creek. This UAA will identify and assess pollutant and non-pollutant factors and their possible impacts on use attainment (even with pollutant control measures in place).

The role of TDS and TSS impairment in Straight Creek and effective BMPs for reducing point and non-point sources of these pollutants will be examined to assess potential water quality improvements for aquatic life use. Anthropogenic and naturally occurring TDS and TSS sources will be addressed in order to confirm an appropriate reference condition

for the Straight Creek aquatic life use. Additionally, these sources will be evaluated to determine the effects of BMPs on water quality and aquatic life use.

3.2 Existing Use

An Existing Use is defined as "a use actually attained in the water body on or after November 28, 1975, whether or not it is included in the water quality standards" (40 CFR 131.3). The existing use identifies a minimum use and level of water quality that must be maintained to protect uses that have already been attained. Since the designated use is the goal/objective for the waterbody, the designated use may or may not have actually been attained in the waterbody. It is important to consider both the distinction and linkage between designated and existing uses. Based on the *Reasonable Grounds Demonstration* submitted to, and approved by the State Water Control Board, it is hypothesized that on or after November 28, 1975, Straight Creek and its tributaries have not met the designated aquatic life use (as interpreted by VA DEQ using the VSCI). Needless to say, this hypothesis could be refuted at any point during the UAA study, in which event, the study will be terminated with appropriate notice to VA DEQ and other interested stakeholders.

When evaluating the uses actually achieved, the existing use of this waterbody will be considered as the "highest degree of use." "Highest degree of use" generally means the degree of use closest to that supported by minimally impacted conditions, which may be associated with the highest level of water quality. At a minimum, the irreducible "attainable" aquatic life use in Straight Creek is the use that can be achieved when 1) limits under CWA 301 (b) and 306 are imposed on point source dischargers and 2) cost-effective and reasonable best management practices are imposed on nonpoint source dischargers. Therefore, it will be necessary to determine, as part of this study, whether and the extent to which these limits and best management practices will improve water quality conditions. This determination will be made based on collected data and information, as well as scientifically defensible projections (see Section 4 below).

To define the Existing Use of Straight Creek and its tributaries, available information gleaned from the sources listed below will be examined.

1. Existing Ecological Records
    a. Existing All Biological & Chemical Data Available
    b. Scientific publications
    c. Permitting agency accounts
    d. TVA fish data
    e. Ongoing ecological studies

2. Historical Records
    a. Tennessee Valley Authority (TVA) Flood studies circa 1960s
    b. Virginia Department of Transportation (VDOT) records
    c. Railroad maps
    d. Newspaper records
    e. Census data
    f. Photographs
    g. Film collections
    h. Other public records

3. Anecdotal/Firsthand Accounts

All available information will be examined. In our study, we will document the rigor and comprehensiveness of all data sets and the degree of confidence, or defensibility of the data. In addition to biological data, water quality measurements will be reviewed and collected. Historical data such as census records, photographs, newspaper articles, etc. will be used to complement instream data when such data are available. As part of the study, we will endeavor to understand how reference conditions have been determined, what they represent and how they inform the study objectives of defining existing uses and projecting the potential for water quality improvement (e.g. undisturbed, minimally or moderately disturbed reference conditions).

The information gathered will be integrated so as to determine biological conditions on/after November 28, 1975. Evaluations conducted in the UAA will be sufficiently detailed to support a determination of the highest attainable use for Straight Creek. The UAA will characterize current and past conditions, as well as project future conditions. This projection will involve identifying the expected condition for Straight Creek, researching BMP effectiveness, examining the efficacy of treatment technology from engineering studies, using water quality models, and making inferences about future conditions given current constraints and planned improvements. Even if non-water quality stressors prevent full attainment, additional implementation efforts may nonetheless improve water quality. The extent of these improvements will be assessed as part of the study.

4.0 A Tool to Predict Biological Condition

4.1 Introduction

A tool will be developed to predict biological condition based on stressors / pressures. This predictive tool will involve three distinct steps. These three steps include:

1. Determine stressors / pressures preventing use attainment;
2. Determine post-remediation stressor / pressure level;
3. Predict highest attainable aquatic life use based on steps 1 & 2.

4.2 Technical Workgroup

This UAA study will rely heavily on this predictive tool. The development of a scientifically defensible tool is paramount. A qualified subset of the stakeholder group will be tasked with helping to develop this tool. This technical workgroup will provide a pathway for input from stakeholders and to relay information and share data. All data will be made available for independent analysis and review by the public.

4.3 Step 1: Determine Stressors / Pressures Preventing Use Attainment

This aspect of the study will be designed to determine: (1) the factors limiting aquatic life use attainment; (2) any segments of the stream that are meeting designated uses; and (3) the potential for incremental water quality improvements. The limiting factor for all of these determinations is resolution in stressor/pressure level versus biological condition.

The TMDL identified two water quality parameters as the "most probable stressors" affecting impairment of the designated aquatic life use. This UAA will not be limited solely to water quality stressors. Other factors affect the assemblage of aquatic organisms in streams. Five such ecologic factors are discussed in EPA's Tiered Aquatic Life Use (TALU) documents. These five factors are:

a) Water Quality
b) Habitat Condition
c) Flow Regime
d) Energy Source
e) Biotic Interaction

Step one of this tool, unlike theoretical models, will be based on actual collected data. The first task will be to collect data from outside Straight Creek, and develop a gradient of stressors / pressures versus biological condition. Since a gradient of stressors / pressures versus biological condition must be developed, the data that will be collected must represent a broad range of conditions. Data must be collected from streams having a broad range of both the stressors / pressures and a broad range of biological conditions.

Then, data from Straight Creek (and perhaps others) will be compared to these gradients so as to validate the tool. The tool needs to accurately predict the measured responses (stressors / pressures and biological condition). This approach is similar to the concept of a Biological Condition Gradient (BCG) and/or the Human Disturbance Gradient (HDG) of a TALU as described by Davies and Jackson (EPA, 2005).

The difference between the original and this UAA's application of the BCG conceptual framework is in the selection of biological tiers. The original concept involves selection of biological attributes (narrative and numeric) for up to six tiers of biological condition (Figure 3). The tiers are determined by a consensus of experts such as regional biologists. Given the narrow geographic scope of this UAA and the specific objectives of this study, it will instead rely on the narrative and numeric criteria for four tiers already developed and presented in VSCI validation report (VA DEQ, 2006). These four tiers are currently being used to determine impairment. Therefore, these four tiers should also be appropriate for evaluating tiers or subcategories of use.

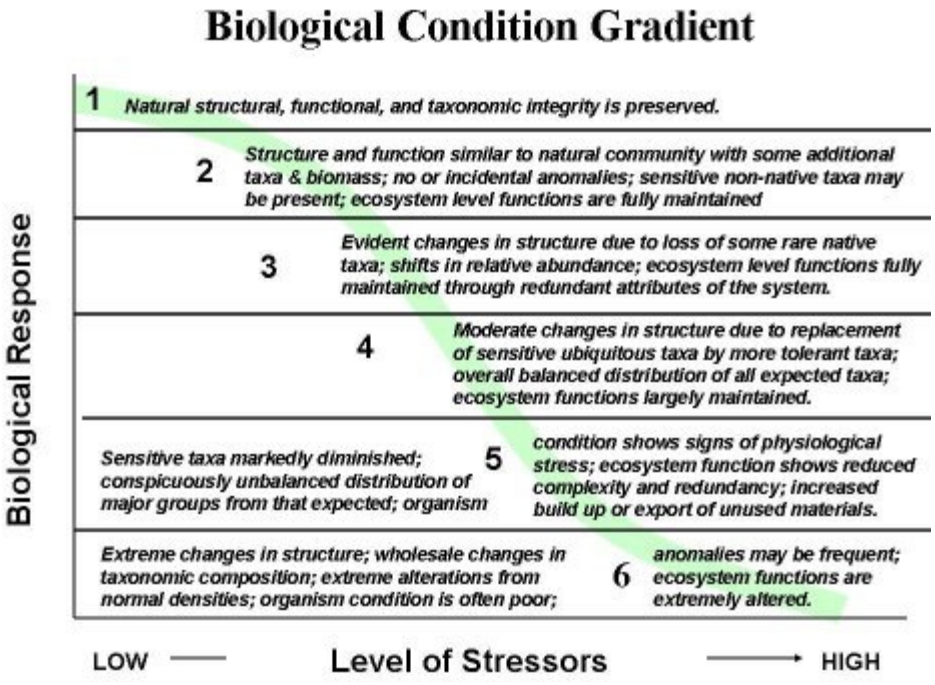

Figure 3 Conceptual Biological Condition Gradient

The predictive tool envisioned for this UAA will examine many streams ranging from high to low biological and disturbance levels. This examination is necessary to develop a tool with application over a broad range of conditions. Next, each of the streams will be classified into one of the VSCI tiers. Then, those same streams will be classified into one of several tiers of stressor / pressure intensity. For example, one stressor gradient could be low, medium, and high RBP habitat quality. Finally, statistical analyses (*e.g.*, discriminant analysis, etc.) will be performed to determine whether stressor tiers can discriminate between VSCI tiers. The relationship could look something like Figure 4. This procedure would be repeated with each candidate stressor/pressure, creating multiple candidate relationships. Techniques such as the weight of evidence approach and EPA risk assessment methods may then be applied to determine the strongest and most appropriate relationships that will comprise the final predictive tool.

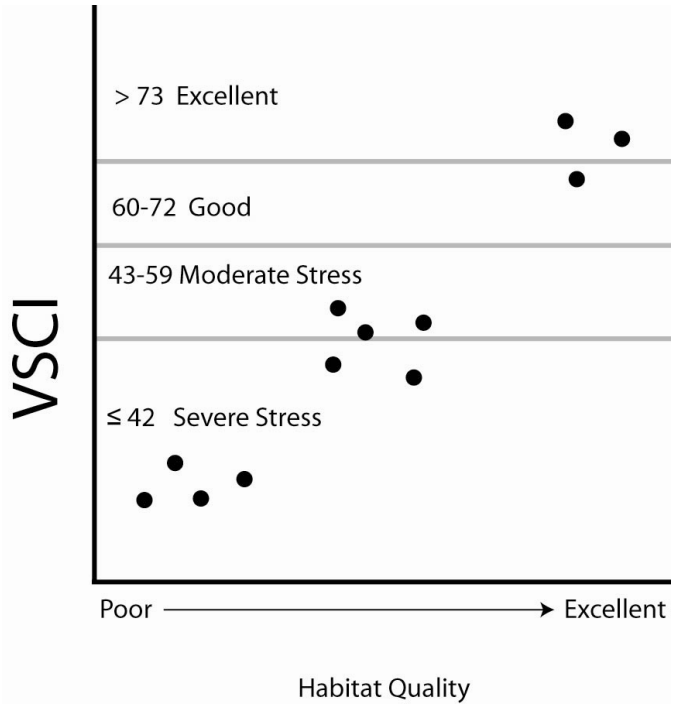

Figure 4 Conceptual Biological Condition Gradient Using VSCI

The gradient of stressors / pressures and biological condition developed will be calibrated to Straight Creek. Calibration will ensure that the available stressor / pressure data for Straight Creek is predictive of its respective biological condition. Validation will use the same approach, but with a subset of Straight Creek data that is withheld from the development and calibration phase.

Step 1 of the predictive tool will be applied to Straight Creek to determine the stressors / pressures (e.g. impervious surface, stream flow, TDS, TSS) preventing aquatic life use attainment. The validated relationship from Step 1 will specify the stressors / pressures that are predictive of Straight Creek's current biological condition. These stressors / pressures will be the factors preventing aquatic life use attainment.

4.4 Step 2: Determine Post-Remediation Stressor / Pressure Levels

A post-remediation tool will be developed based on both observed and literature data to predict the stressor / pressure level following remediation efforts. In accordance with Minute 13 Condition 3 (VA DEQ 2007), stream monitoring will be conducted following these efforts to gauge the level of water quality improvement. In order to determine feasible remediation efforts, the UAA study will be integrated (shared data) with the Straight Creek TMDL IP and VPDES permitting process. Other concepts for determining feasible remediation efforts may include Risk Assessments and Environmental Impact Statement (EIS) framework (*e.g.*, Alternatives Analysis).

The results of these implementation efforts will be used to develop the post-remediation model. The model will be developed using data from ongoing remediation, historical and current monitoring, literature, and BMP modeling. In fact, remediation and monitoring efforts have been underway since TMDL approval.

The post-remediation model will be validated by monitoring the effects of the phased remediation efforts. In this manner, appropriate goals for improvements in Straight Creek and its tributaries may be achieved.

4.5 Step 3: Predict Highest Attainable Aquatic Life Use

No assumption has been made as to the extent of aquatic life use attainment in Straight Creek. The state's current practice is to assess the extent of such attainment using the VSCI and a default threshold score of 60 to distinguish creeks that are impaired from those in attainment. It is conceivable that this study will provide scientific support for assigning a different VSCI score to protect the highest attainable use in Straight Creek.

Of course, any proposed change to the designated use or criteria is subject to formal rule making and public comment. Such changes are outside the scope of this UAA.

Once post-remediation watershed conditions (physical, chemical and/or biological) have been estimated (Step 2), the highest attainable use can be determined. The output of the post-remediation model (Step 2) will be applied to the relationship between stressors / pressures and biological condition (Step 1). This process will specify the highest attainable aquatic life use and the criteria to protect that use.

5.0 Remediation Efforts

5.1 General

The following section provides lists of remediation efforts (BMPs) suggested for Point Sources and Non-point Sources through the integrated TMDL IP and UAA processes for remediation of stressors (TMDL IP section 6.2). This UAA will use data collected from some of these projects as the basis for validation of the predictive tool. The list has been itemized for actions that will be utilized as well as those actions that may be used as necessary to achieve further reductions.

5.2 Remediation Actions

Point Source Discharges

- Use of land clearing debris (trees, shrubs, etc.) to create filter strips along the surface contour
- Over-sizing sediment ponds and sumps (providing longer retention periods)
- Constructing headwalls at drainage culvert inlets and stabilized splash areas at the outlets to minimize erosion
- Accelerated maintenance (more frequent clean-out) of sediment ponds and roadway sumps
- Installation of rock check gabion dams to serve as pre-filters for channeled flows
- Regrading to approximate the original contour, where practical or at a minimum grading to prevent pooling and infiltration during final reclamation.
- Installation of surface diversion ditches, collection sumps, or swales
    - Where possible, diversions should be constructed in undisturbed areas to prevent the passage of surface water over disturbed areas
- Low-permeability caps or seals in final reclamation of impoundment.
- Revegetation (establishment on an accelerated schedule, use of temporary cover crops, increasing mulching rates, etc)

- Sealing of streams or diversions crossing disturbed areas
- Sealing of subsidence fissures
- Installation of mine drains at down-dip adits to prevent saturation of seal materials
- Construction of highwall drains (vertical and horizontal) to reduce contact with spoil material
- Construction of level-spreaders at the outlets of diversion ditches to reduce flow velocities and erosion (Not specified for early phases of implementation)

Non-point Sources

- Straight Pipe Removal
- US Army Corps of Engineers AML projects
- Stream Bank Stabilization
- Use of land clearing debris (trees, shrubs, etc.) to create filter strips along the surface contour
- Regrading to approximate the original contour, where practical or at a minimum grading to prevent pooling and infiltration.
- Installation of surface diversion ditches, collection sumps, or swales
    - Where possible, diversions should be constructed in undisturbed areas to prevent the passage of surface water over disturbed areas
- Low-permeability caps or seals.
- Revegetation (establishment on an accelerated schedule, use of temporary cover crops, increasing mulching rates, etc)
- Sealing of streams or diversions crossing disturbed areas
- Sealing of subsidence fissures
- Construction of highwall drains (vertical and horizontal) to reduce contact with spoil material
- Daylighting of abandoned mine workings
- Sealing of mine adits and auger holes to exclude oxygen
- Installation of mine drains at down-dip adits to prevent saturation of seal materials

- Constructing headwalls at drainage culvert inlets and stabilized splash areas at the outlets to minimize erosion (Not specified for early phases of implementation).
- Construction of level-spreaders at the outlets of diversion ditches to reduce flow velocities and erosion (Not specified for early phases of implementation).

5.3 Implementation Monitoring

Several projects have been selected to monitor the response of the aquatic system following implementation in response to Condition 3, Minute 13 from the State Water Control Board (VA DEQ 2007). The following is a list of these remediation projects. Data collected during monitoring phases will be used to validate or improve the predictive tool.

- BMPs for Point Sources
    - Revegetation rate increase in impoundment areas
    - Road Sump and pond cleanout preventative maintenance schedules increase.
    - Over-sizing sediment ponds and sumps (providing longer retention periods)
    - Installation of rock check gabion dams to serve as pre-filters for channeled flows
    - Installation of surface diversion ditches, collection sumps, or swales
    - Sealing of streams or diversions crossing disturbed areas
    - Will be used to gauge the response of the aquatic system as required by SWCB Minute 13 (SWCB March 2007).

- St. Charles North Sewer Expansion
    - 110 New Hookups
    - Will be used to gauge the response of the aquatic system as required by SWCB Minute 13 (SWCB March 2007)

- Fawn Branch Decentralized Sewer System
    - 11 New Hookups
    - Will be used to gauge the response of the aquatic system as required by SWCB Minute 13 (SWCB March 2007).

- US Army Corps of Engineers (USACE) Remediation Projects

- Load reductions for each effort will be calculated based upon TMDL documents
- Projects identified and prioritized by USACE and DMLR
- Will be used to gauge the response of the aquatic system as required by SWCB Minute 13 (SWCB March 2007).

- Stream Bank Stabilization Projects
    - IP will quantify sites & expected load reductions
    - For example, Gin Creek
    - Will be used to gauge the response of the aquatic system as required by SWCB Minute 13 (SWCB March 2007).

6.0 Timeline

The following table presents a proposed timeline for the UAA study for Straight Creek. This timeline will be adjusted, as needed, to reflect data and information developed over the course of the study.

Table 1. Generalized Timeline for Straight Creek UAA

Item	Timing
Assemble Workgroup (Comprehensive)	90 days following study plan approval
Assemble Technical Workgroup	90 days following study plan approval
Workgroup Meetings	Annually
Technical Workgroup Meetings	Quarterly
Formulate Industrial BMP list	90 days following study plan approval
Formulate load reductions plan	180 days following study plan approval
Data Gathering	6 months following study plan approval
Existing Use Determination	6 months following study plan approval
Determine what is causing impairment	1 year following study plan approval
Evaluate TDS / TSS role in impairment	1 year following study plan approval
Predictive Tool Development	2 years following study plan approval
Final Report with recommendations	3 years following study plan approval

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Glossary

- BCG — Biological Condition Gradient
- BMI — Biological Monitoring, Inc.
- BMP — Best Management Practice
- CFR — Code of Federal Regulations
- DALU — Designated Aquatic Life Use
- DMME — Virginia Department of Mines, Minerals and Energy
- EIS — Environmental Impact Statement
- EMAP — Environmental Monitoring and Assessment Program
- EPA — United States Environmental Protection Agency
- Group — Virginia Mining Issues Group (Formerly known as Virginia Coalfields TMDL Group
- HDG — Human Disturbance Gradient
- LMPI — Lone Mountain Processing, Inc.
- RBP — Rapid Bioassessment Protocol
- SWCB — Virginia State Water Control Board
- TALU — Tiered Aquatic Life Use
- TDS — Total Dissolved Solids
- TSS — Total Suspended Solids
- TMDL — Total Maximum Daily Load
- TMDL IP — Total Maximum Daily Load Implementation Plan
- TVA — Tennessee Valley Authority
- UAA — Use Attainability Analysis
- USACE — United States Army Corps of Engineers
- USGS — United States Geological Survey
- VA DEQ — Virginia Department of Environmental Quality
- VDOT — Virginia Department of Transportation